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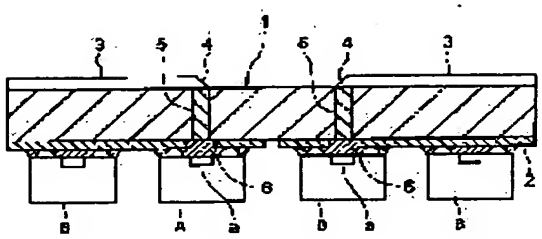
(54) MOUNTING SUBSTRATE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a mounting substrate having structure which is easily manufactured in the mounting substrate for mixedly mounting both optical devices and electronic devices.
SOLUTION: Electric wiring 2 is formed on the surface on which optical devices A and electronic devices B are mounted and also optical waveguides 3 are formed on the surface of the opposite side, total reflection mirror parts 4 are formed at the end parts of the optical waveguides 3 so as to orthogonally bend optical signals from the optical waveguides 3 toward the light receiving and emitting parts of the optical devices A, and optical waveguide parts 5 which connect the total reflection mirror parts 4 of the optical waveguides 3 to the light receiving and emitting parts a of the optical devices A are formed within the substrate. The optical signals within the optical waveguide are efficiently transmitted to the optical device and also the optical signals from the optical device are received by the optical waveguide with simple structure even if the optical waveguide in which a 45° total reflection mirror is formed is not reversed as in a conventional technique.



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CLAIMS

[Claim(s)]
[Claim 1] While being a substrate for mounting for loading together both optical device and electron device and forming electric wiring in the field of the side which carries an optical device and an electron device Optical waveguide is formed in the field of the opposite side, and the total reflection mirror section is formed in the edge of optical waveguide so that a lightwave signal may be bent at a right angle towards the carrier light-emitting part of an optical device from the optical waveguide. The substrate for mounting characterized by forming in the interior of a substrate the optical waveguide part which connects the total reflection mirror section of optical waveguide, and the carrier light-emitting part of an optical device.
[Claim 2] The substrate for mounting according to claim 1 characterized by the ingredient of a substrate being silicon.
[Claim 3] The substrate for mounting according to claim 1 or 2 characterized by forming the optical waveguide part inside the substrate which connects the total reflection mirror section of optical waveguide, and the carrier light-emitting part of an optical device by resin.
[Claim 4] The substrate for mounting according to claim 3 characterized by using electrodeposted resin for the resin which forms an optical waveguide part.
[Claim 5] The substrate for mounting according to claim 1 to 4 characterized by making between the carrier light-emitting part of an optical device, and the substrate sides which are optical device loading sides into the structure which is not hollow.
[Claim 6] The photoelectron substrate according to claim 1 to 4 characterized by filling up with resin between the carrier light-emitting part of an optical device, and the substrate sides which are optical device loading sides.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the substrate for mounting for OPUTOERETOKURONIKUSU carrying both optical device and electron device.
[0002]
[Description of the Prior Art] In recent years, the amount of information on a network is increasing by leaps and bounds, and the technique of transmitting and processing a vast quantity of data for this reason is needed with the rapid spread of the Internet. For example, in order, as for CPU, for a clock rate to come to exceed 1GHz in order to improve processing speed, and to make possible data transfer of broadband width of face further more, efforts to increase bus width of face and raise a data transfer rate are made.
[0003] However, these technical development aims at the improvement in capacity by the electrical signal, in transfer of the electrical signal on electric wiring, is faced performing signal processing at high speed, and has a technical problem peculiar to an electrical signal, namely, the noise by RC delay and the cross talk accompanying improvement in the speed of a signal and electromagnetism — there are problems which should be solved, such as a radiation noise, and in the electrical signal, the high speed signal processing and transmission corresponding to a future demand serve as a difficult situation, and serves as a neck of the improvement in capacity of a system.
[0004] On the other hand, the lightwave signal has the descriptions, such as a high speed, low loss, and no guiding. Then, the photoelectron technique (optoelectronics) in which a lightwave signal performs a transmission part and an electrical signal performs the processing section taking advantage of this description has attracted attention. This has the place depended on the steady advance of the carrier light emitting device of light like semiconductor laser or a photodiode.
[0005]
[Problem(s) to be Solved by the Invention] It faces loading together an optical device and an electron device on the same substrate, and producing the module for optoelectronics, and although a pig tail type with the connection of an optical fiber is used, each device, especially optical device will serve as the situation where the substrate carrying a device is filled with the optical-fiber section of **** of an optical device, if the scale of a system becomes large. For this reason, the optical surface mount technology (light SMT) which applied the concept of the surface mount which carries an electron device in the printed circuit board in which electrical signal wiring was formed has attracted attention. That is, wiring for electrical signals and the optical waveguide for lightwave signals tend to be formed in a substrate front face, and it is going to carry out the surface mount of an electron device or the optical device.
[0006] According to this optical surface mount technology, although wiring for electrical signals and the waveguide for lightwave signals are formed in the front face of a substrate at a plane, since an optical device is carried at right angles to a substrate, the carrier light emitting device section will counter a substrate front face. Therefore, it is necessary to form an optical path perpendicularly from the optical waveguide on the front face of a substrate. For this reason, in

order to bend an optical path, the structure which forms the total reflection mirror of 45 degrees in the optical waveguide section is proposed (electronics mounting technology, Vol.16, No.1, Mikami, p32-37, "the present condition of optoelectronics mounting technology and a technical problem").
[0007] However, by the approach shown in this reference, since a diamond blade cuts optical waveguide and the end face of 45 degrees is made, light will not be bent on the substrate top face, but it will turn at it in the direction of a substrate inferior surface of tongue. Therefore, the optical waveguide which formed the total reflection mirror 45 degrees must be imprinted to other substrates, and must be made into the opposite sense.
[0008] The place which this invention is made in view of the above situations, and is made into the purpose is to offer the substrate for mounting of the structure which does not need to reverse the optical waveguide which formed the total reflection mirror 45 degrees, therefore can be manufactured easily.
[0009]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, while this invention is a substrate for mounting for loading together both optical device and electron device and electric wiring is formed in the field of the side which carries an optical device and an electron device Optical waveguide is formed in the field of the opposite side, and the total reflection mirror section is formed in the edge of optical waveguide so that a lightwave signal may be bent at a right angle towards the carrier light-emitting part of an optical device from the optical waveguide. It is characterized by forming in the interior of a substrate the optical waveguide part which connects the total reflection mirror section of optical waveguide, and the carrier light-emitting part of an optical device.
[0010] In the substrate for mounting of the above-mentioned configuration, it is desirable to use silicon (Si) for the ingredient of a substrate.
[0011] Moreover, in the substrate for mounting of the above-mentioned configuration, it is desirable that the optical waveguide part inside the substrate which connects the total reflection mirror section of optical waveguide and the carrier light-emitting part of an optical device is formed by resin. And it is desirable that electrodeposted resin is used for the resin which forms the optical waveguide part.
[0012] Moreover, in the substrate for mounting of the above-mentioned configuration, it is desirable to make between the carrier light-emitting part of an optical device and the substrate sides which are optical device loading sides into the structure which is not hollow. And it is desirable to fill up with resin between the carrier light-emitting part of the optical device and the substrate sides which are optical device loading sides.
[0013]
[Embodiment of the Invention] Drawing 1 is the outline block diagram showing the condition of having carried the optical device and the electron device in the substrate for mounting concerning this invention.
[0014] While the electric wiring 2 of an electrical signal, a power source, a gland, etc. is formed in one field and the optical device A and electron device B are carried after the wiring 2, as for the substrate 1 for mounting, optical waveguide 3 is formed in the field of another side. And the total reflection mirror section 4 is formed in the edge of optical waveguide 3 so that a lightwave signal may be bent at a right angle towards the carrier light-emitting part a of the optical device A from the optical waveguide 3. Furthermore, [0015] by which the optical waveguide part 5 which connects the total reflection mirror section 4 of optical waveguide 3 and the carrier light-emitting part a of the optical device A is formed in the interior of a substrate 1 By the module using the substrate 1 for mounting of the above-mentioned configuration, a lightwave signal will be bent by the total reflection mirror section 4 of the edge of optical waveguide 3 at right angles to the opposite side of a substrate 1, and will get across to the optical device A efficiently through the optical waveguide part 5 inside a substrate.
[0016] Furthermore, in the processing process of a substrate 1, it becomes possible to form a perpendicularly deep hole in a substrate side by using the silicon used for semiconductor device production as an ingredient of a substrate 1.

[0017] Moreover, it becomes possible by using electrodeposted resin, such as polyimide and an acrylic, for the optical waveguide part 5 inside a substrate 1 to fill up with resin the hole formed in the silicon substrate.
[0018] Furthermore, in case the optical device A is carried in the substrate 1 for mounting with the above structures, if between the carrier light-emitting part a of the optical device A and substrate sides is filled up with the structure 6 which is not hollow, for example, resin, the lightwave signal which has passed along the optical waveguide part 5 will reach the optical device A efficiently, without passing along a part with the refractive index from which resin called space differs greatly.
[0019] Drawing 2 - drawing 4 are process drawings showing the manufacture procedure of the substrate for mounting concerning this invention, and explain a manufacture procedure with reference to these drawings below.
[0020] First, the substrate 10 which consists of silicon as shown in drawing 2 (a) is prepared. And by exposure through a predetermined photo mask, and development following it, after performing predetermined pretreatment to this substrate 10 and coating a photoresist, as shown in drawing 2 (b), the resist layer 11 is formed. next, CF4 after performing baking and stiffening the resist layer 11 and SF6 etc. — gas — O2 Plasma etching of a substrate 10 is performed using the added mixed gas, and as shown in drawing 2 (c), the perpendicularly deep hole 12 is formed in a substrate 10. As shown in drawing 2 (d) after an appropriate time, the resist layer 11 is exfoliated.
[0021] Subsequently, as shown in drawing 3 (a), the resin layer 13 is formed in the front face of a substrate 10, and the interior of a hole with electrodeposted polyimide liquid. In addition, although a resin layer may be formed by coating, since the hole where it is smaller to use electrodeposted resin, such as polyimide, like this example is also buried certainly, it is desirable. Then, as shown in drawing 3 (b), on the resin layer 13, copper foil is stuck and a conductive layer 14 is formed. In addition, a conductive layer may be formed by plating. And resist platemaking is performed in order to carry out patterning of the electric wiring by photo etching. By exposure through a predetermined photo mask, and development following it, after coating a photoresist, as the resist layer 15 is formed as shown in drawing 3 (c), and shown in drawing 3 (d), a conductive layer 14 is etched and, specifically, patterning of the wiring 16 is carried out. Then, Au plating of nickel substrate is performed to the terminal area of wiring 16.
[0022] Thus, after carrying out patterning of the electric wiring to one field, as shown in drawing 4 (a), the part of the hole 12 which ground the rear face of a substrate 10 and was filled up with the resin of the resin layer 13 is exposed. Subsequently, as shown in drawing 4 (b), the resin layer 17 is formed in the polished surface of a substrate 10. It is desirable to use electrodeposted resin, such as polyimide, also in this case. Then, as shown in drawing 4 (c), the pattern of optical waveguide 18 is formed using an acrylic photopolymer, it is covered and the covering layer 19 is formed. In this case, it is desirable to form a covering layer using a polyimide system ingredient. And the total reflection mirror section of the include angle of 45 degrees is formed in the edge of optical waveguide 18 by the processing method using a diamond blade. Thereby, as shown in drawing 4 (d), the substrate for mounting is obtained.
[0023] Where resin is inserted into the predetermined location of the substrate for mounting produced as mentioned above in between if needed, the **** module shown in drawing 1 can be manufactured by carrying an optical device and an electron device.
[0024] As mentioned above, although this invention has been explained to a detail based on the gestalt of operation, it stands to reason that various modification is possible for the substrate for mounting by this invention in the range which is not limited to the gestalt of the above-mentioned implementation at all, and does not deviate from the meaning of this invention.
[0025] For example, although this invention is the description with big dividing optical waveguide and electric wiring into both sides of a substrate, when this is seen from the whole substrate, it is a part of configurations. Therefore, what is necessary is just to form an electric connection in a field with optical waveguide, if it is when it is better to also make connection of electric wiring from a viewpoint of connection with a mother board from the field in which optical waveguide is formed.

[0026]
[Effect of the Invention] As explained above, the substrate for mounting of this invention While being a substrate for mounting for loading together both optical device and electron device and forming electric wiring in the field of the side which carries an optical device and an electron device Optical waveguide is formed in the field of the opposite side, and the total reflection mirror section is formed in the edge of optical waveguide so that a lightwave signal may be bent at a right angle towards the carrier light-emitting part of an optical device from the optical waveguide. Since it is characterized by forming in the interior of a substrate the optical waveguide part which connects the total reflection mirror section of optical waveguide, and the carrier light-emitting part of an optical device Even if it does not reverse the optical waveguide which formed the total reflection mirror 45 degrees, according to easy structure, the lightwave signal in optical waveguide can be efficiently told to an optical device, and the lightwave signal from an optical device can be received in optical waveguide.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram showing the condition of having carried the optical device and the electron device in the substrate for mounting concerning this invention.
[Drawing 2] It is process drawing showing the manufacture procedure of the substrate for mounting concerning this invention.
[Drawing 3] It is process drawing following drawing 2 .
[Drawing 4] It is process drawing following drawing 3 .
[Description of Notations]
A An optical device
Carrier light-emitting part
B Electron device
1 Substrate
2 Wiring
3 Optical Waveguide
4 Total Reflection Mirror Section
5 Optical Waveguide Part
6 Resin
10 Substrate
11 Resist Layer
12 Hole
13 Resin Layer
14 Conductive Layer
15 Resist Layer
16 Wiring
17 Resin Layer
18 Optical Waveguide
19 Covering Layer

[Translation done.]

MOUNTING SUBSTRATE

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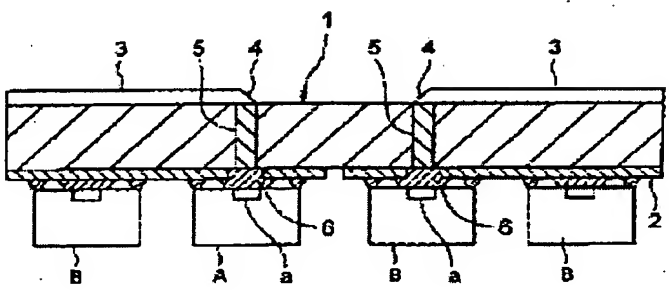
- international: ***G02B6/122; G02B6/13; G02B6/42; H05K1/02;*** **G02B6/122; G02B6/13; G02B6/42; H05K1/02;** (IPC1-7): G02B6/122; G02B6/13; G02B6/42; H05K1/02
- european:
Application number: JP20000297982 20000929
Priority number(s): JP20000297982 20000929

Abstract of **JP2002107560**

PROBLEM TO BE SOLVED: To provide a mounting substrate having structure which is easily manufactured in the mounting substrate for mixedly mounting both optical devices and electronic devices. SOLUTION: Electric wiring 2 is formed on the surface on which optical devices A and electronic devices B are mounted and also optical waveguides 3 are formed on the surface of the opposite side, total reflection mirror parts 4 are formed at the end parts of the optical waveguides 3 so as to orthogonally bend optical signals from the optical waveguides 3 toward the light receiving and emitting parts of the optical devices A, and optical waveguide parts 5 which connect the total reflection mirror parts 4 of the optical waveguides 3 to the light receiving and emitting parts a of the optical devices A are formed within the substrate. The optical signals within the optical waveguide are efficiently transmitted to the optical device and also the optical signals from the optical device are received by the optical waveguide with simple structure even if the optical waveguide in which a 45 deg. total reflection mirror is formed is not reversed as in a conventional technique.



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	6/13		H05K	1/02	T	2H047
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H05K	1/02				A	
					M	

審査請求　未請求　請求項の数６　ＯＬ　（全 5 頁）

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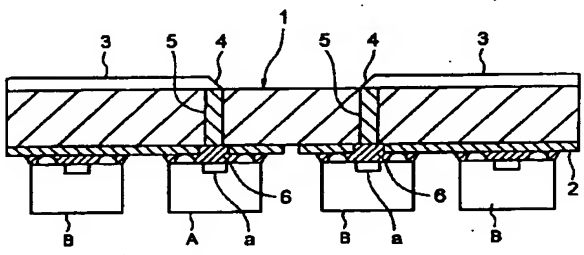
DA06
2H047 KA03 KB08 LA09 MA07 PA21
PA24 QA05 TA32 TA44
5E338 AA18 BB63 BB75 CC01 CC10
CD11 EE31

(54)【発明の名称】　実装用基板

(57)【要約】
【課題】　光デバイスと電子デバイスの両者を混載するための実装用基板であって、簡単に製造できる構造の実装用基板を提供する。
【解決手段】　光デバイスＡと電子デバイスＢを搭載する側の面に電気的な配線２が形成されているとともに、反対側の面には光導波路３が形成されており、その光導波路３から光デバイスＡの受発光部ａに向けて光信号を直角に曲げるように光導波路３の端部に全反射ミラー部４が形成され、基板内部には光導波路３の全反射ミラー部４と光デバイスＡの受発光部ａとをつなぐ光導波路部分５が形成されている構成とする。従来技術のように４５度全反射ミラーを形成した光導波路を反転しなくても、簡単な構造により、光導波路内の光信号を効率よく光デバイスに伝え、また光デバイスからの光信号を光導波路に受けることができる。



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【特許請求の範囲】

【請求項１】　光デバイスと電子デバイスの両者を混載するための実装用基板であって、光デバイスと電子デバイスを搭載する側の面に電気的な配線が形成されているとともに、反対側の面には光導波路が形成されており、その光導波路から光デバイスの受発光部に向けて光信号を直角に曲げるように光導波路の端部に全反射ミラー部が形成され、基板内部には光導波路の全反射ミラー部と光デバイスの受発光部とをつなぐ光導波路部分が形成されていることを特徴とする実装用基板。

【請求項２】　基板の材料がシリコンであることを特徴とする請求項１に記載の実装用基板。

【請求項３】　光導波路の全反射ミラー部と光デバイスの受発光部とをつなぐ基板内部の光導波路部分が樹脂で形成されていることを特徴とする請求項１又は２に記載の実装用基板。

【請求項４】　光導波路部分を形成する樹脂に電着樹脂が用いられていることを特徴とする請求項３に記載の実装用基板。

【請求項５】　光デバイスの受発光部と光デバイス搭載面である基板面との間を中空でない構造としたことを特徴とする請求項１～４のいずれかに記載の実装用基板。

【請求項６】　光デバイスの受発光部と光デバイス搭載面である基板面との間を樹脂で充填したことを特徴とする請求項１～４のいずれかに記載の光電子基板。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、光デバイスと電子デバイスの両者を搭載するオプトエレトクロニクス用の実装用基板に関するものである。

【０００２】

【従来の技術】近年、インターネットの急激な普及により、ネットワーク上の情報量は飛躍的に増大しており、このため膨大なデータを伝達し処理する技術が必要となってきている。例えば、処理速度を向上するために、ＣＰＵはクロック速度が１ＧＨｚを越えるようになり、さらにより広帯域幅のデータ転送を可能とするために、バス幅を増やしてデータ転送速度を向上させる努力がなされている。

【０００３】しかしながら、これらの技術的な開発は、電気信号による能力向上を目指しており、電気配線上の電気信号の伝達では、信号処理を高速で行うに際して電気信号特有の課題がある。すなわち、信号の高速化に伴うＲＣ遅延、クロストークによるノイズ、電磁輻射ノイズ等の解決すべき問題があり、将来の要求に見合う高速信号処理・伝送が電気信号では困難な状況となり、システムの能力向上のネックとなっている。

【０００４】一方、光信号は、高速、低損失、無誘導等の特徴をもっている。そこで、この特徴を活かし、伝送部を光信号で行い、処理部を電気信号で行うという光電

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子技術（オプトエレクトロニクス）が注目されてきた。これは、半導体レーザーやフォトダイオードのような光の受発光素子の着実な進歩によるところがある。

【０００５】

【発明が解決しようとする課題】光デバイスと電子デバイスを同じ基板上に混載してオプトエレクトロニクス用モジュールを作製するに際し、個々のデバイス、特に光デバイスは光ファイバーの接続部を持つピッグテールタイプが使用されるが、システムの規模が大きくなると、光デバイスの余丁の光ファイバー部でデバイスを搭載する基板が埋め尽くされる事態となる。このため、電子デバイスを電気信号配線を形成したプリント基板に搭載する表面実装の概念を適用した光表面実装技術（光ＳＭＴ）が注目されてきた。すなわち、基板表面に電気信号用の配線と光信号用の光導波路を形成し、電子デバイスや光デバイスを表面実装しようとするものである。

【０００６】この光表面実装技術によれば、基板の表面に電気信号用の配線及び光信号用の導波路が平面状に形成されるが、光デバイスは基板に垂直に搭載されるために、受発光素子部が基板表面に対向することとなる。したがって、基板表面の光導波路から垂直に光路を形成する必要がある。このため、光路を曲げるために、４５度の全反射ミラーを光導波路部に形成する構造が提案されている（エレクトロニクス実装技術、Vol.16, No.1、三上、ｐ32－37、「光エレクトロニクス実装技術の現状と課題」）。

【０００７】しかしながら、この文献に示された方法では、ダイヤモンドブレードにより光導波路を切断して４５度の端面を作りだすことから、光は基板上面に曲げられるのではなく、基板下面方向に曲がることになる。そのため、４５度全反射ミラーを形成した光導波路は、他の基板に転写して反対向きにしなければならない。

【０００８】本発明は、上記のような事情に鑑みてなされたものであり、その目的とするところは、４５度全反射ミラーを形成した光導波路を反転する必要がなく、したがって簡単に製造できる構造の実装用基板を提供することにある。

【０００９】

【課題を解決するための手段】上記の目的を達成するため、本発明は、光デバイスと電子デバイスの両者を混載するための実装用基板であって、光デバイスと電子デバイスを搭載する側の面に電気的な配線が形成されているとともに、反対側の面には光導波路が形成されており、その光導波路から光デバイスの受発光部に向けて光信号を直角に曲げるように光導波路の端部に全反射ミラー部が形成され、基板内部には光導波路の全反射ミラー部と光デバイスの受発光部とをつなぐ光導波路部分が形成されていることを特徴としている。

【００１０】上記の構成の実装用基板において、基板の材料にシリコン（Ｓｉ）を用いることが好ましい。

【００１１】また、上記構成の実装用基板において、光導波路の全反射ミラー部と光デバイスの受発光部とをつなぐ基板内部の光導波路部分が樹脂で形成されていることが好ましい。そして、その光導波路部分を形成する樹脂に電着樹脂が用いられていることが好ましいものである。

【００１２】また、上記構成の実装用基板において、光デバイスの受発光部と光デバイス搭載面である基板面との間を中空でない構造とすることが好ましい。そして、その光デバイスの受発光部と光デバイス搭載面である基板面との間を樹脂で充填することが好ましいものである。

【００１３】

【発明の実施の形態】図１は本発明に係る実装用基板に光デバイスと電子デバイスを搭載した状態を示す概略構成図である。

【００１４】実装用基板１は、一方の面に電気信号、電源、グランド等の電気的な配線２が形成され、その配線２の上に光デバイスＡと電子デバイスＢが搭載されるとともに、他方の面に光導波路３が形成されている。そして、その光導波路３から光デバイスＡの受発光部ａに向けて光信号を直角に曲げるように光導波路３の端部に全反射ミラー部４が形成されている。さらに、基板１の内部には光導波路３の全反射ミラー部４と光デバイスＡの受発光部ａとをつなぐ光導波路部分５が形成されている

【００１５】上記構成の実装用基板１を用いたモジュールでは、光信号が光導波路３の端部の全反射ミラー部４により基板１の反対面に垂直に曲げられ、基板内部の光導波路部分５を通って効率よく光デバイスＡに伝わることになる。

【００１６】さらに、基板１の材料として半導体素子作製に用いられるシリコンを使用することにより、基板１の加工工程において、基板面に垂直に深い穴を形成することが可能となる。

【００１７】また、基板１の内部の光導波路部分５にポリイミド、アクリル等の電着樹脂を用いることにより、シリコン基板に形成した穴に樹脂を充填することが可能となる。

【００１８】さらに、上記のような構造を持つ実装用基板１に光デバイスＡを搭載する際に、光デバイスＡの受発光部ａと基板面の間を中空でない構造、例えば樹脂６にて充填すると光導波路部分５を通ってきた光信号が空間という樹脂とは大きく異なる屈折率を持つ部分を通ることなく効率よく光デバイスＡに到達する。

【００１９】図２～図４は本発明に係る実装用基板の製造手順を示す工程図であり、以下にこれらの図面を参照して製造手順を説明する。

【００２０】まず、図２（ａ）に示すようにシリコンからなる基板１０を用意する。そして、この基板１０に所定の前処理を施した後、フォトレジストをコーティングしてから、所定のフォトマスクを介しての露光とそれに続く現像により、図２（ｂ）に示す如くレジスト層１１を形成する。次に、ベーキングを行ってレジスト層１１を硬化させた後、CF_4，SF_6等のガスにO_2を添加した混合ガスを使用して基板１０のプラズマエッチングを行い、図２（ｃ）に示すように基板１０に垂直に深い穴１２を形成する。しかる後、図２（ｄ）に示すようにレジスト層１１を剥離する。

【００２１】次いで、図３（ａ）に示すように、電着ポリイミド液にて基板１０の表面及び穴の内部に樹脂層１３を形成する。なお、コーティングにより樹脂層を形成してもよいが、この例のようにポリイミド等の電着樹脂を使用した方が小さな穴も確実に埋まるので好ましい。続いて、図３（ｂ）に示すように、樹脂層１３の上に銅箔を貼り合わせて導電層１４を形成する。なお、メッキで導電層を形成しても構わない。そして、電気配線をフォトエッチングによりパターニングするため、レジスト製版を行う。具体的には、フォトレジストをコーティングしてから、所定のフォトマスクを介しての露光とそれに続く現像により、図３（ｃ）に示す如くレジスト層１５を形成し、図３（ｄ）に示すように、導電層１４をエッチングして配線１６をパターニングする。その後、配線１６の端子部にＮｉ下地のＡｕメッキを行う。

【００２２】このように一方の面に電気配線をパターニングした後、図４（ａ）に示すように、基板１０の裏面を研磨して樹脂層１３の樹脂で充填された穴１２の部分を露出させる。次いで、図４（ｂ）に示すように、基板１０の研磨面に樹脂層１７を形成する。この場合も、ポリイミド等の電着樹脂を使用するのが好ましい。続いて、図４（ｃ）に示すように、アクリル系の感光性樹脂を用いて光導波路１８のパターンを形成し、それを覆ってカバーレイヤ１９を形成する。この場合、ポリイミド系材料を用いてカバーレイヤを形成するのが好ましい。そして、ダイヤモンドブレードを用いた加工法により、光導波路１８の端部に４５度の角度の全反射ミラー部を形成する。これにより、図４（ｄ）に示すように、実装用基板が得られる。

【００２３】上記のようにして作製した実装用基板の所定位置に、必要に応じて樹脂を間に挟んだ状態で、光デバイスと電子デバイスを搭載することにより、図１に示す如きモジュールを製造することができる。

【００２４】以上、本発明を実施の形態に基づいて詳細に説明してきたが、本発明による実装用基板は、上記実施の形態に何ら限定されるものではなく、本発明の趣旨を逸脱しない範囲において種々の変更が可能であることは当然のことである。

【００２５】例えば、本発明は、光導波路と電気的な配線とを基板の両面に分離することが大きな特徴であるが、これは基板全体から見ると一部の構成である。したがって、マザーボードとの接続の観点から、光導波路が

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形成されている面から電気的な配線の接続もした方がよい場合などにあっては、光導波路のある面に電気的な接続部を形成すればよい。

【００２６】

【発明の効果】以上説明したように、本発明の実装用基板は、光デバイスと電子デバイスの両者を混載するための実装用基板であって、光デバイスと電子デバイスを搭載する側の面に電気的な配線が形成されているとともに、反対側の面には光導波路が形成されており、その光導波路から光デバイスの受発光部に向けて光信号を直角に曲げるように光導波路の端部に全反射ミラー部が形成され、基板内部には光導波路の全反射ミラー部と光デバイスの受発光部とをつなぐ光導波路部分が形成されていることを特徴としているので、４５度全反射ミラーを形成した光導波路を反転しなくても、簡単な構造により、光導波路内の光信号を効率よく光デバイスに伝え、また光デバイスからの光信号を光導波路に受けることができる。

【図面の簡単な説明】

【図１】本発明に係る実装用基板に光デバイスと電子デバイスを搭載した状態を示す概略構成図である。

【図２】本発明に係る実装用基板の製造手順を示す工程図である。

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＊【図３】図２に続く工程図である。

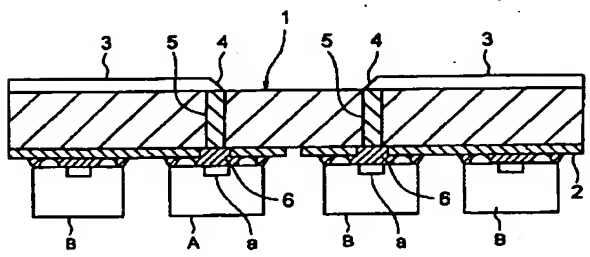
【図４】図３に続く工程図である。

【符号の説明】

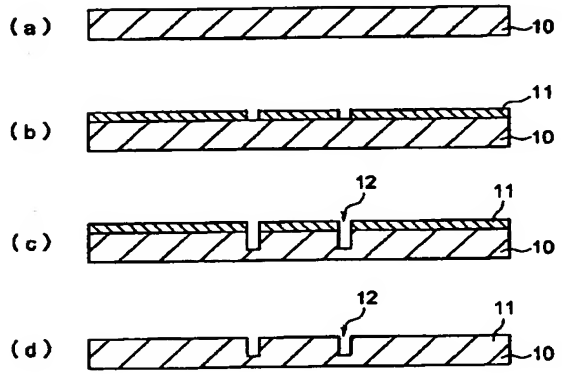
A　光デバイス
a　受発光部
B　電子デバイス
１　基板
２　配線
３　光導波路
４　全反射ミラー部
５　光導波路部分
６　樹脂
１０　基板
１１　レジスト層
１２　穴
１３　樹脂層
１４　導電層
１５　レジスト層
１６　配線
１７　樹脂層
１８　光導波路
１９　カバーレイヤ

＊

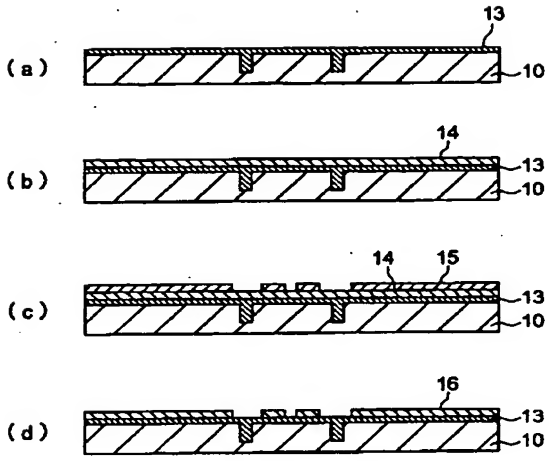
【図１】



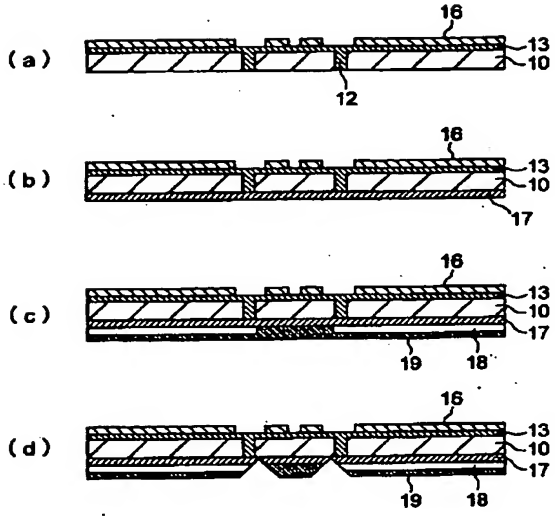
【図２】



【図３】


(a)
13
10
(b)
14
13
10
(c)
14
15
13
10
(d)
16
13
10

【図４】


(a)
16
13
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(b)
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